of the north Atlantic was decidedly below the average; easterly gales prevailed from the English Channel and Irish Sea eastward to W. 30° and southeasterly gales between W, 30° and 40°; northerly gales prevailed from Newfoundland southward to N. 30°, the whole constituting a very extensive whirl around the storm-center as above located for this date; there are also evidences of the beginning of an independent whirl south of the principal one.

On the 12th the lowest pressure apparently extended as a long oval northwest and southeastward, with its center at N. 40° and W. 40°. At noon of the 13th the map shows a large area of pressure 29.5 or less, the center being as before, N. 40°, W. 40°, but the barometer had now fallen decidedly over England, the highest pressure had been rapidly transferred to southern Germany, and pressure had also fallen over the Atlantic States and Canadian Provinces. At noon of the 14th the center of lowest pressure and revolving winds was at N. 43°, W. 36°, and at noon of the 15th the low pressure extended as a trough northeast and southwest between N. 40° and N. 50°, the center being at N. 45° and W. 30°, but subsidiary and minor depressions were at this time also central in northern Scotland, France, and northern Russia. On the 16th pressure had recovered over northern and central Europe, but low pressures with attending whirlwinds were central west of Ireland at N. 52°, W. 18°, and on the western portion of the Atlantic in connection with the low center over the Gulf of Saint Lawrence.

From this date, during the 17th, 18th, and 19th, a continuous gale, sometimes of hurricane force, prevailed on the European coast; in the English Channel southeast winds prevailed on the 16th, west winds on the 17th, and northwest on the 18th and 19th, which, by the 20th, had veered to northeast with clearing weather and high pressure; the lowest pressure was central on the 17th at N. 56°, W. 4°; on the 18th at N. 54°, E. 3°, and also at N. 44°, E. 8°; on the 19th at N. 53°, E. 9°, and also at N. 45°, E. 11°; on the 20th at N. 49°, E. 11°, and also N. 43°, E. 12°. On the 21st these latter low pressures had filled up and others had developed in northern and central Russia, respectively.

While this extensive storm area was thus, on the 16th to the 20th, moving slowly eastward through western Europe and while an extensive depression was moving down the Saint Lawrence Valley the pressure rose steadily over the Atlantic Ocean between N. 10° and N. 60°, W. 10° and W. 50°; although a belt of high pressure was thus made to prevail from the south Atlantic states to Algeria yet it may be an open question whether the barometric rise north of this zone should be considered as due to a bodily movement of the zone northward; although southerly winds prevailed for a time in the eastern portion of the Atlantic yet by noon of the 20th the pressure was higher between N. 45° and 60° than it was to the southward, and on the 21st the central highest pressure (30.6 to 30.7) extended from Ireland westward to W. 35°, so that the growth, the location, and the movements of this area of high pressure which, in fact, continued nearly stationary until the 24th, must be attributed to a general descending current over this portion of the Atlantic precisely similar to the descending high pressure areas of the North American continent.

*E.* From the 16th to the 23d several low areas passed over Labrador to the Atlantic Ocean north of our marine reports and evidently pursued a northeasterly course toward Greenland and Iceland, keeping on the northern side of the general area of high pressure just described; on the 24th the low area No. XI of the American series was off the New England coast, and on the 25th it was central in the Gulf of Saint Lawrence; this also moved northeastward over Labrador beyond our stations and kept to the north of the above-mentioned high area. On the 28th the American area of low pressure No. XII*c* passed down the Saint Lawrence Valley and on the 29th passed northeastward over Labrador and remained beyond the limit of our reports. While these several low areas were thus pursuing extreme northerly paths and while high pressure prevailed from Great Britain southwest and west the pressure remained permanently low in the northern part of Norway and this low area undoubtedly extended westward to southern Greenland.

### OCEAN ICE IN NOVEMBER.

The limits of the regions within which field ice or icebergs were reported for November, 1893, are shown on Chart I by crosses.

The southernmost ice, reported on the 13th, was in N. 50° 40′, W. 54° 13′, and the easternmost ice, reported on the 2d, in N. 52° 51′, W. 52° 20′. The ice of the current month was noted on two dates in the Straits of Belle Isle, and six high bergs were reported eastward from the Straits.

No Arctic ice was reported for November, 1892. In November, 1891, an iceberg was observed in N. 51° 58′, W. 55° 35′, on the 8th. In November, 1890, a small piece of ice was noted in N. 46° 35′, W. 47° 51′. In November, 1882, 1883, 1887, and 1888, no ice was reported near Newfoundland and the Grand Banks. In November, 1884 and 1889, several icebergs were seen over the eastern part of the Banks of Newfoundland. On one date in November, 1885, and one date in November, 1886, ice was observed south of the 50th parallel.

### OCEAN FOG IN NOVEMBER.

The limits of fog belts west of the 40th meridian, as determined by reports of shipmasters, are shown on Chart I by dotted shading. Near the Grand Banks of Newfoundland fog was reported on 8 dates; between the 55th and 65th meridians on 3 dates; and west of the 65th meridian no fog was reported. Compared with the corresponding month of the last 6 years the dates of occurrence of fog near the Grand Banks numbered 2 less than the average; between the 55th and 65th meridians the same as the average.

## TEMPERATURE OF THE AIR (expressed in degrees Fahrenheit).

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are, however, not drawn for the higher irregular surface of the Rocky Mountain plateau; the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country over which they are drawn; in mountainous regions such isotherms would be controlled largely by the topography, and it is, therefore, not practicable to present the temperature data in this manner unless a contour map on a large scale is published as a base chart.

In the table of meteorological data from voluntary observers the actual mean temperature is given for each station, and in the tables of climatological data for the regular stations of the Weather Bureau both the mean temperatures and the departures from the normal are given. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal. The normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.

For regular stations of the Weather Bureau the monthly mean temperature is the simple mean of all daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to the table of meteorological data.

During November, 1893, the mean temperature was highest in southern Florida and at Key West, where it was from 70 to 75; it was lowest in Saskatchewan, being 11.1 at Prince Albert and 13.4 at Battleford. The temperature averaged 32 along a zone running from central Maine southwest to central Vermont, thence northwest just north of Lake Huron through the southern part of Lake Superior southward to the southern part of Wisconsin, thence to northern Iowa, central South Dakota, the southern boundary of Wyoming, southern Idaho, northern Idaho, and central British Columbia.

## DEPARTURES FROM NORMAL TEMPERATURE.

As compared with the normal for this month the mean temperature for November, 1893, was in excess 0.4 at Key West, and from 0 to 1.7 in Maine, the Canadian Provinces, the Saint Lawrence Valley, and the northern portion of the Lake region; elsewhere the temperature has generally been deficient, the maximum deficiencies being 3.5 at Baltimore, Md.; 3.0 at Lynchburg, Va.; 3.8 at Fort Smith, Ark.; 3.1 at Springfield, Mo., and Davenport, Iowa; 3.2 at Springfield, Ill.; 3.5 at Cincinnati, Ohio; 3.7 at Louisville, Ky.; 5.7 at Qu'Appelle, Assiniboia; 7.4 at Medicine Hat, Assiniboia; 8.1 at Calgary, Alberta; 9.4 at Edmonton, Alberta; 4.3 a Olympia, Wash.; 2.7 at Yuma, Ariz., and Los Angeles, Cal.; 3.0 at Tucson, Ariz.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for November for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for November, 1893; (4) the departure of the current month from the normal; (5) the extreme monthly means for November during the period of observation and the years of their occurrence:

*Departures from normal temperature*—Continued.

| State and station. | (1) Normal for the month of Nov. | (2) Length of record. | (3) Mean for Nov., 1893. | (4) Departure from normal. | (5) Extreme monthly means for November. | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Highest. | Year. | Lowest. | Year. |
| *Arizona.* | ° | Years | ° | ° | ° | | ° | |
| Fort Apache | 43.4 | 22 | 43.6 | + 0.2 | 48.1 | 1873 | 38.5 | 1880 |
| Fort Mohave | 59.9 | 21 | 56.7 | — 3.2 | 66.2 | 1873 | 53.4 | 1880 |
| Whipple Barracks | 43.7 | 21 | 40.4 | — 3.3 | 48.4 | 1875 | 36.1 | 1886 |
| *Arkansas.* | | | | | | | | |
| Keesees Ferry | 47.2 | 11 | 45.6 | — 1.6 | 51.2 | 1890 | 44.1 | 1889 |
| *California.* | | | | | | | | |
| Riverside | 57.7 | 11 | 53.7 | — 4.0 | 59.7 | 1884 | 53.7 | 1893 |
| *Colorado.* | | | | | | | | |
| Las Animas | 37.2 | 10 | 37.1 | — 0.1 | 42.6 | 1892 | 29.4 | 1889 |
| *Florida.* | | | | | | | | |
| Merritts Island | 67.9 | 11 | 68.1 | + 0.2 | 73.3 | 1883 | 60.0 | 1885 |
| *Georgia.* | | | | | | | | |
| Forsyth | 56.6 | 18 | 57.8 | + 1.2 | 61.7 | 1874, 90 | 51.0 | 1880 |
| *Idaho.* | | | | | | | | |
| Boise Barracks | 38.9 | 19 | 37.6 | — 1.3 | 45.8 | 1885 | 31.5 | 1880 |
| Fort Sherman | 36.2 | 9 | 34.2 | — 2.0 | 42.6 | 1890 | 25.4 | 1886 |
| *Indiana.* | | | | | | | | |
| Lafayette | 39.6 | 10 | 38.6 | — 1.0 | 44.6 | 1890 | 36.6 | 1892 |
| *Iowa.* | | | | | | | | |
| Cresco | 28.7 | 21 | 29.5 | + 0.8 | 34.7 | 1878 | 19.2 | 1880 |
| *Kansas.* | | | | | | | | |
| Eureka Ranch | 39.7 | 10 | 37.1 | — 2.6 | 44.7 | 1885 | 30.3 | 1887 |
| Independence | 43.9 | 21 | 41.8 | — 2.1 | 50.7 | 1878 | 33.6 | 1880 |
| *Louisiana.* | | | | | | | | |
| Grand Coteau | 59.6 | 11 | 57.8 | — 1.8 | 64.0 | 1883 | 56.2 | 1889 |
| *Maine.* | | | | | | | | |
| Orono | 34.0 | 23 | 33.7 | — 0.3 | 38.6 | 1889 | 27.1 | 1875 |
| *Maryland.* | | | | | | | | |
| Cumberland | 40.0 | 22 | 39.0 | — 1.0 | 44.7 | 1883 | 35.0 | 1880 |
| *Michigan.* | | | | | | | | |
| Kalamazoo | 37.1 | 17 | 36.5 | — 0.6 | 43.4 | 1890 | 27.0 | 1880 |
| *Missouri.* | | | | | | | | |
| Sedalia | 43.3 | 10 | 41.4 | — 1.9 | 46.7 | 1887 | 38.5 | 1891 |
| *Montana.* | | | | | | | | |
| Fort Custer | 33.2 | 14 | 31.7 | — 1.5 | 39.9 | 1890 | 24.5 | 1880 |
| *Nebraska.* | ° | Years | ° | ° | ° | | ° | |
| Fort Robinson | 35.9 | 9 | 35.4 | — 0.5 | 40.7 | 1885 | 31.8 | 1886 |
| Genoa (near) | 33.7 | 17 | 34.4 | + 0.7 | 39.8 | 1890 | 22.6 | 1880 |
| *Nevada.* | | | | | | | | |
| Browns | 41.2 | 21 | ..... | ..... | 46.7 | 1891 | 25.8 | 1880 |
| Carson City | 37.7 | 16 | 39.7 | + 2.0 | 42.2 | 1885 | 31.4 | 1881 |
| *New Hampshire.* | | | | | | | | |
| Hanover | 34.1 | 22 | 34.7 | + 0.6 | 37.1 | 1877 | 24.8 | 1873 |
| *New Mexico.* | | | | | | | | |
| Deming | 54.2 | 12 | 57.0 | + 2.8 | 61.2 | 1892 | 47.2 | 1881 |
| Fort Wingate | 39.6 | 22 | ..... | ..... | 44.4 | 1891 | 31.4 | 1880 |
| *New York.* | | | | | | | | |
| Cooperstown | 34.9 | 22 | 35.0 | + 0.1 | 38.5 | 1876, 77 | 26.8 | 1873 |
| Plattsburg Barracks | 34.4 | 22 | 35.2 | + 0.8 | 39.0 | 1889 | 25.3 | 1873 |
| *North Carolina.* | | | | | | | | |
| Lenoir | 45.1 | 21 | 44.0 | — 1.1 | 49.8 | 1890 | 39.9 | 1872 |
| *Oklahoma.* | | | | | | | | |
| Fort Reno | 47.6 | 10 | 48.6 | + 1.0 | 51.5 | 1885 | 42.7 | 1889 |
| Fort Sill | 47.8 | 21 | 46.4 | — 1.4 | 52.9 | 1879 | 36.6 | 1880 |
| Fort Supply | 44.2 | 12 | 41.4 | — 2.8 | 48.8 | 1885 | 39.2 | 1889 |
| *Oregon.* | | | | | | | | |
| Bandon | 49.3 | 9 | 49.0 | — 0.3 | 52.0 | 1891 | 43.0 | 1886 |
| *Pennsylvania.* | | | | | | | | |
| Dyberry | 34.7 | 20 | 35.0 | + 0.3 | 38.3 | 1883 | 24.9 | 1878 |
| Grampian | 35.3 | 22 | 34.1 | — 1.2 | 39.2 | 1890 | 29.3 | 1872 |
| Wellsboro | 38.0 | 14 | 33.5 | — 4.5 | 41.4 | 1885 | 33.5 | 1893 |
| *South Carolina.* | | | | | | | | |
| Statesburg | 53.6 | 12 | 52.5 | — 1.1 | 58.2 | 1890 | 51.2 | 1891 |
| *South Dakota.* | | | | | | | | |
| Fort Sully | 30.5 | 22 | 33.2 | + 2.7 | 39.2 | 1878 | 21.1 | 1880 |
| *Texas.* | | | | | | | | |
| Austin | 57.6 | 21 | 56.8 | — 0.8 | 63.2 | 1883 | 46.0 | 1880 |
| Silver Falls | 49.6 | 7 | 49.1 | — 0.5 | 52.4 | 1890 | 45.3 | 1889 |
| *Utah.* | | | | | | | | |
| Terrace | 35.8 | 21 | 37.1 | + 1.3 | 46.0 | 1885 | 24.1 | 1880 |
| *Vermont.* | | | | | | | | |
| Strafford | 33.4 | 20 | 33.7 | + 0.3 | 37.9 | 1886 | 23.4 | 1873 |
| *Virginia.* | | | | | | | | |
| Dale Enterprise | 46.2 | 13 | 39.7 | — 6.5 | 49.6 | 1888 | 39.7 | 1893 |
| *Washington.* | | | | | | | | |
| Fort Townsend | 43.2 | 18 | 40.1 | — 3.1 | 47.3 | 1884 | 39.2 | 1880 |
| *West Virginia.* | | | | | | | | |
| Parkersburg | 46.0 | 12 | 41.5 | — 4.5 | 55.7 | 1881 | 40.1 | 1886 |
| *Wisconsin.* | | | | | | | | |
| Madison | 33.2 | 15 | 32.6 | — 0.6 | 38.4 | 1890 | 27.3 | 1872 |
| *Wyoming.* | | | | | | | | |
| Fort Washakie | 27.3 | 9 | 27.3 | 0.0 | 34.5 | 1890 | 10.1 | 1880 |

## TEMPERATURE, JANUARY TO NOVEMBER, 1893.

For the period, January 1st to November 30th, the average temperature was about normal in the west Gulf states. In districts where the temperature was in excess the average excess above the normal was as follows: extreme northwest, 0.5; southern Rocky Mountain slope, 1.3.

In regions where the temperature was deficient the average deficit for this period was: New England, 1.3; middle Atlantic states, 1.3; south Atlantic states, 0.7; Key West, Fla., 0.5; east Gulf states, 0.4; west Gulf states, 0.1; Ohio Valley and Tennessee, 0.8; lower lake region, 0.9; upper lake region, 0.7; extreme northwest, 0.5; upper Mississippi valley, 1.3; Missouri Valley, 0.8; northern slope, 1.3; middle slope, 1.0; southern slope, 1.3; southern plateau region, 0.4; middle plateau region, 1.7; northern plateau region, 2.9; north Pacific slope, 2.3; middle Pacific slope, 1.9; south Pacific slope, 1.5.

## YEARS OF HIGHEST MEAN TEMPERATURE FOR NOVEMBER.

The mean temperature for November, 1893, does not seem to have been the highest on record at any of the regular stations of the Weather Bureau.

The highest mean temperature for November generally occurred east of the Mississippi River and south of the Ohio River, in the Northwest, and along the middle and south Pacific coasts in 1890; over the middle and northern plateau regions in 1885; over the lower lake region, Pennsylvania, and New York in 1883; along the middle Atlantic and south New England coasts in 1881; in the west Gulf states in 1879; over the upper lake region and in the middle Missouri valley in 1878.

### YEARS OF LOWEST MEAN TEMPERATURE FOR NOVEMBER.

The mean temperature for November, 1893, was the lowest on record at Fresno, Cal., the average being 52.8, or 2.6 below the normal; the previous lowest was 54.1 in 1889.

The lowest mean temperature for November occurred in the Southwest in 1889; on the north and south Pacific coasts in 1886; on the middle Pacific coast in 1882; and from the Alleghany Mountain range over the central valleys, the Lake region, and the Rocky Mountain and plateau regions in 1880.

### MAXIMUM TEMPERATURE.

The highest temperatures recorded for November at regular stations of the Weather Bureau are given in the table of climatological data, from which the following are selected: Key West, Fla., 83 on the 21st; Jupiter, Fla., 85 on the 23d; Tampa, Fla., 85 on the 4th; Titusville, Fla., 83 on the 22d; Jacksonville, Fla., 84 on the 5th; Corpus Christi, Tex., 86 on the 8th; Abilene, Tex., 86 on the 1st; San Antonio, Tex., 85 on the 2d; Yuma, Ariz., 86 on the 8th; Tucson, Ariz., 84 on the 1st; San Diego, Cal., 84 on the 14th; Los Angeles, Cal., 86 on the 14th; Eastport, Me., 60 on the 3d; Northfield, Vt., 60 on the 2d; Duluth, Minn., 61 on the 7th; Saint Vincent, Minn., 58 on the 7th; Havre, Mont., 64 on the 5th; Tatoosh Island, Wash., 53 on the 18th and 56 on the 7th.

### MINIMUM TEMPERATURE.

The lowest temperatures recorded at Weather Bureau stations are shown in the table of climatological data, from which the following are selected: Saint Vincent, Minn., —24 on the 29th; Havre, Mont., —16 on the 30th; Moorhead, Minn., —20 on the 24th; Bismarck, N. Dak., —15 on the 30th; Miles City, Mont., —14 on the 30th; Northfield, Vt., +2 on the 27th; Eastport, Me., +12 on the 27th; Jacksonville, Fla., 32 on the 25th; Mobile, Ala., and Pensacola, Fla., 32 on the 24th; Corpus Christi, Tex., 30 on the 24th; Key West, Fla., 64 on the 25th; Yuma, Ariz., 32 on the 19th.

### DAILY AND MONTHLY RANGES OF TEMPERATURE.

The greatest daily range of temperature is given for each station in the table of climatological data for Weather Bureau stations. The extreme monthly ranges were 87 at Moorhead, Minn.; 85, Huron, S. Dak.; 82, Valentine, Nebr., Bismarck, N. Dak., and Saint Vincent, Minn.; 84, Saint Paul, Minn. Among the smaller monthly ranges were 19 at Key West, Fla., and Tatoosh Island, Wash.; 24, Fort Canby, Wash.; 36, Galveston, Tex., and New York, N. Y.; 37, Harrisburg, Pa., and Nantucket, Mass.

### LIMITS OF FREEZING TEMPERATURE.

The southern limit of the region within which the air has had a freezing temperature at some time during the month is approximately shown by the full and dotted lines on Chart VI joining the places at which the minimum temperatures of 32 and of 40, respectively, occurred within the instrument shelters of the Weather Bureau; the latter minimum is usually accompanied by a more or less severe frost on the ground outside of the shelter. During November, 1893, the line of minimum 40 extended from a short distance below Jacksonville, Fla., southwestward across the peninsula to Tampa; it reappears again on the Louisiana coast south of New Orleans and follows the coast to Corpus Christi, Tex.; it reappears on the Pacific coast at San Diego, Cal., and follows the coast line to some point north of San Francisco, Cal.

### FROST.

The reports of frosts injurious to vegetation are as follows: 4th, Parker, Ariz., vegetables killed. 12th, Wilgus, Ariz., vegetation killed. 15th, Alexandria, La., buds on sugar cane killed; Plant City, Fla., tender vegetation killed on lowlands. 19th, Oracle, Ariz., tomato vines killed. 24th, Society Hill, S. C., tender vegetation killed; Alexandria, La., most of the cane killed. 25th, in northern Florida, plants and vegetables damaged.

The following table shows the dates of the occurrence of the first light frost, the first heavy frost, and the first snowfall at the respective stations:

*Dates of first light and heavy frosts and snow, November, 1893.*

| State and station. | First frost. | | |
|---|---|---|---|
| | Light. | Heavy. | Snow. |
| *Alabama.* | | | |
| Bermuda | ..... | 15 | ..... |
| Elba | ..... | 16 | ..... |
| Eufaula | ..... | 16 | ..... |
| Greensboro | ..... | 15 | ..... |
| Mobile | ..... | 16 | ..... |
| Newberg | ..... | ..... | 14 |
| Starlington | ..... | 16 | ..... |
| Thomasville | ..... | 15 | ..... |
| *Arizona.* | | | |
| Dudleyville | ..... | 13 | ..... |
| Holbrook | ..... | ..... | 23 |
| Natural Bridge | ..... | 29 | ..... |
| Oracle | ..... | 19 | ..... |
| Parker | ..... | 4 | ..... |
| Rye | 14 | 21 | ..... |
| Saint Helenas Ranch | ..... | 18 | ..... |
| Show Low | ..... | ..... | 20 |
| Signal | ..... | 1 | ..... |
| Tucson | ..... | 20 | ..... |
| Walnut Ranch | ..... | ..... | 20 |
| Yuma | 20 | ..... | ..... |
| *Arkansas.* | | | |
| Ashdown | ..... | 15 | ..... |
| Conway | ..... | 15 | ..... |
| Kirby | ..... | 14 | ..... |
| Ozark | ..... | 13 | ..... |
| Stuttgart | ..... | 15 | ..... |
| Winslow | ..... | 13 | ..... |
| *California.* | | | |
| Anderson | 1 | ..... | ..... |
| Citrus | ..... | ..... | 16 |
| Crescent City | 17 | 21 | ..... |
| Edmauton | ..... | ..... | 25 |
| Eureka | ..... | 17 | ..... |
| Folsom City | 10 | ..... | ..... |
| Fresno | 16 | 18 | ..... |
| Georgetown | ..... | 17 | ..... |
| Gridley | ..... | 3 | ..... |
| Hydesville | 15 | 17 | ..... |
| Independence | ..... | ..... | 17 |
| Iowa Hill | ..... | 17 | ..... |
| Jackson | ..... | 16 | ..... |
| Julian | ..... | 18 | 16 |
| Keeler | 25 | ..... | 17 |
| Mariposa | 18 | ..... | 17 |
| Napa | 2 | ..... | ..... |
| Nordhoff | 12 | 18 | ..... |
| Oakdale | 11 | ..... | ..... |
| Oleta | 10 | 18 | ..... |
| Pasadena | 18 | ..... | ..... |
| Pomona | 20 | ..... | ..... |
| Red Bluff | ..... | 19 | ..... |
| Sacramento | ..... | 19 | ..... |
| San Ardo | ..... | 18 | ..... |
| San Bernardino | 16 | ..... | 17 |
| San Diego | 20 | ..... | ..... |
| San Jacinto | ..... | 11 | 17 |
| Santa Maria | 18 | ..... | ..... |
| Shasta | ..... | ..... | 26 |
| Susanville | ..... | ..... | 23 |
| Tulare | ..... | 18 | ..... |
| Ukiah | 2 | 18 | .. .. |
| Upper Mattole | 12 | 15 | ..... |
| Vacaville | ..... | 19 | ..... |
| West Butte | 19 | ..... | ..... |
| Wheatland | ..... | 19 | ..... |
| Willows | ..... | 16 | ..... |
| Winchester | ..... | ..... | 17 |
| *Colorado.* | | | |
| Abbott | ..... | ..... | 9 |
| Arboles | ..... | ..... | 17 |
| Avoca | ..... | ..... | 10 |
| Brush | ..... | ..... | 11 |
| Castle Rock | ..... | ..... | 10 |
| Cheyenne Wells | ..... | ..... | 22 |
| Colbran | ..... | ..... | 25 |
| Cope | ..... | ..... | 10 |
| Delta | ..... | ..... | 17 |
| Divide Exper. Station | ..... | ..... | 10 |
| Eastdale | ..... | ..... | 10 |
| Gold Hill | ..... | ..... | 10 |
| Grand Junction | ..... | ..... | 17 |
| Gunnison | ..... | ..... | 6 |
| Julesburg | ..... | ..... | 10 |
| Kirk | ..... | ..... | 21 |
| Lamar | ..... | ..... | 10 |
| Leslie | ..... | ..... | 7 |
| Loveland | ..... | ..... | 21 |
| McCoy | ..... | ..... | 7 |
| Middle Box Elder | ..... | ..... | 21 |
| Monte Vista | ..... | ..... | 11 |
| Parachute | ..... | ..... | 18 |
| Paonia | ..... | ..... | 26 |
| Pueblo | ..... | ..... | 17 |
| *Colorado*—Continued. | | | |
| Rocky Ford | ..... | ..... | 11 |
| Scissors | ..... | ..... | 10 |
| Surface Creek | ..... | ..... | 18 |
| T. S. Ranch | ..... | ..... | 18 |
| Twin Lakes | ..... | ..... | 11 |
| Wallet | ..... | ..... | 21 |
| Wilde | ..... | ..... | 11 |
| Yuma | ..... | ..... | 10 |
| *Connecticut.* | | | |
| Bridgeport | ..... | ..... | 15 |
| Falls Village | ..... | ..... | 4 |
| Greenfield Hill | ..... | ..... | 15 |
| Hartford | ..... | ..... | 4 |
| Middletown | ..... | ..... | 15 |
| New Hartford | ..... | ..... | 15 |
| New Haven | ..... | ..... | 15 |
| New London | ..... | ..... | 15 |
| Wallingford | ..... | ..... | 15 |
| Waterbury | ..... | ..... | 1 |
| West Simsbury | ..... | ..... | 4 |
| *Delaware.* | | | |
| Millsboro | ..... | ..... | 24 |
| Kirkwood | ..... | ..... | 15 |
| Seaford | ..... | ..... | 15 |
| *District of Columbia.* | | | |
| Washington | ..... | ..... | 15 |
| *Florida.* | | | |
| Amelia | ..... | 16 | ..... |
| Archer | ..... | 16 | ..... |
| Brooksville | 16 | ..... | ..... |
| Federal Point | 25 | ..... | ..... |
| Green Cove Springs | 15 | ..... | ..... |
| Jacksonville | 16 | 25 | ..... |
| Lake City | ..... | 16 | ..... |
| Moseley Hall | ..... | 16 | ..... |
| Orlando | 16 | ..... | ..... |
| Oxford | 25 | ..... | ..... |
| Pensacola | 16 | ..... | ..... |
| Plant City | 16 | ..... | ..... |
| *Georgia.* | | | |
| Blakely | ..... | 16 | ..... |
| Brag | ..... | 16 | ..... |
| Camilla | ..... | 16 | ..... |
| Clayton | ..... | 1 | ..... |
| Darien | ..... | 25 | ..... |
| Fleming | ..... | 16 | ..... |
| Hawkinsville | ..... | 25 | ..... |
| Homerville | ..... | 16 | ..... |
| Lumpkin | ..... | 16 | ..... |
| McArthur | ..... | 1 | ..... |
| Newnan | ..... | 16 | ..... |
| Piscola | ..... | 16 | ..... |
| Poulan | ..... | 16 | ..... |
| *Illinois.* | | | |
| Atwood | ..... | ..... | 21 |
| Aurora | ..... | ..... | 21 |
| Bloomington | ..... | ..... | 21 |
| Braidwood | ..... | ..... | 15 |
| Bushnell | ..... | ..... | 21 |
| Chicago | ..... | ..... | 15 |
| Cordova | ..... | ..... | 30 |
| Dixon | ..... | ..... | 21 |
| East Peoria | ..... | ..... | 21 |
| Fort Sheridan | ..... | ..... | 21 |
| Galva | ..... | ..... | 21 |
| Griggsville | ..... | ..... | 21 |
| Havana | ..... | ..... | 21 |
| Lagrange | ..... | ..... | 21 |
| Louisville | ..... | ..... | 20 |
| Martinsville | ..... | ..... | 23 |
| Mattoon | ..... | ..... | 18 |
| Mount Pulaski | ..... | ..... | 21 |
| Olney | ..... | ..... | 26 |
| Oregon | ..... | ..... | 21 |
| Oswego | ..... | ..... | 21 |
| Ottawa | ..... | ..... | 15 |
| Palestine | ..... | ..... | 23 |
| Paris | ..... | ..... | 30 |
| Peoria | ..... | ..... | 21 |
| Quincy | ..... | ..... | 21 |
| Rantoul | ..... | ..... | 14 |
| Riley | ..... | ..... | 21 |
| Rockford | ..... | ..... | 15 |
| Rushville | ..... | ..... | 20 |
| Springfield | ..... | ..... | 21 |
| Streator | ..... | ..... | 13 |
| Sycamore | ..... | ..... | 21 |
| Walnut | ..... | ..... | 21 |
| Warsaw | ..... | ..... | 21 |
| Winnebago | ..... | ..... | 21 |
| *Indiana.* | | | |
| Angola | ..... | ..... | 15 |
| Ashboro | ..... | ..... | 26 |
| Cambridge City | ..... | ..... | 15 |

*Dates of first light and heavy frosts and snow*—Continued.

| State and station. | First frost. Light. | First frost. Heavy. | Snow. |
|---|---|---|---|
| *Indiana*—Continued. | | | |
| Connersville | | | 15 |
| Crawfordsville | | | 25 |
| Columbia City | | | 15 |
| Delphi | | | 21 |
| Farmland | | | 15 |
| Franklin | | | 15 |
| Huntington | | | 21 |
| Indianapolis | | | 15 |
| Kokomo | | | 23 |
| Lafayette | | | 15 |
| Logansport | | | 15 |
| Marion | | | 15 |
| Mauzy | | | 15 |
| Muncie | | | 15 |
| Rockville | | | 23 |
| Valparaiso | | | 20 |
| Worthington | | | 23 |
| *Indian Territory.* | | | |
| Purcell | | 5 | |
| *Iowa.* | | | |
| Algona | | | 11 |
| Alta | | | 11 |
| Amana | | | 30 |
| Ames | | | 12 |
| Atlantic | | | 12 |
| Audubon | | | 10 |
| Belle Plaine | | | 12 |
| Bonaparte | | | 12 |
| Carroll | | | 11 |
| Cedar Falls | | | 21 |
| Cedar Rapids | | | 12 |
| Centerville | | | 12 |
| Charles City | | | 12 |
| Clarinda | | | 12 |
| Clinton | | | 21 |
| College Springs | | | 29 |
| Corning | | | 11 |
| Cresco | | | 11 |
| Davenport | | | 12 |
| Decorah | | | 21 |
| Delaware | | | 24 |
| Des Moines | | | 12 |
| Dubuque | | | 11 |
| Elkader | | | 26 |
| Emmetsburg | | | 11 |
| Fort Madison | | | 21 |
| Galva | | | 11 |
| Greenfield | | | 11 |
| Grinnell | | | 11 |
| Grundy Center | | | 11 |
| Hampton | | | 11 |
| Hopeville | | | 24 |
| Humboldt | | | 21 |
| Independence | | | 21 |
| Indianola | | | 24 |
| Iowa City | | | 21 |
| Iowa Falls | | | 11 |
| Jefferson | | | 25 |
| Keokuk | | | 21 |
| Keosauqua | | | 12 |
| Knoxville | | | 12 |
| Larrabee | | | 11 |
| Mason City | | | 11 |
| Maxon | | | 12 |
| Mechanicsville | | | 21 |
| Monticello | | | 21 |
| Newton | | | 12 |
| Osage | | | 11 |
| Oskaloosa | | | 29 |
| Ovid | | | 12 |
| Panama | | | 11 |
| Richland | | | 12 |
| Rock Rapids | | | 11 |
| Sibley | | | 11 |
| Sioux City | | | 11 |
| Spirit Lake | | | 11 |
| Storm Lake | | | 11 |
| Tipton | | | 21 |
| Vinton | | | 12 |
| Webster City | | | 24 |
| Williams | | | 11 |
| *Kansas.* | | | |
| Abilene | | | 11 |
| Achilles | | | 11 |
| Allison | | | 11 |
| Atchison | | | 29 |
| Beloit | | | 11 |
| Bucklin | | | 11 |
| Cawker City | | | 11 |
| Colby | | | 11 |
| Coldwater | | | 9 |
| Cunningham | | 14 | 22 |
| Dodge City | | | 11 |
| Downs | | | 11 |
| Engelwood | | | 11 |
| Eureka Ranch | | | 22 |
| Garden City | | | 11 |
| Gove | | | 11 |
| Grainfield | | | 10 |
| Grinnell | | | 22 |
| Hays City | | | 22 |
| Horton | | | 29 |
| Hutchinson | | | 11 |
| *Kansas*—Continued. | | | |
| Kiowa | | | 12 |
| Lakin | | | 22 |
| Lebo | | | 11 |
| Leoti | | | 20 |
| Liberal | | | 11 |
| Macksville | | | 11 |
| Manhattan | | | 11 |
| Marion | | | 11 |
| Medicine Lodge | | | 11 |
| Minneapolis | | | 11 |
| Morland | | | 11 |
| Morton | | | 11 |
| Monument | | | 22 |
| Mount Hope | | | 11 |
| Oberlin | | | 11 |
| Rome | | 13 | |
| Sharon Springs | | | 10 |
| Sterling | | | 22 |
| Topeka | | | 29 |
| Tribune | | | 11 |
| Utica | | | 22 |
| Wa Keeney | | | 10 |
| Wallace | | | 22 |
| Wamego | | | 11 |
| Winona | | | 10 |
| *Kentucky.* | | | |
| Mount Sterling | | | 23 |
| Sandy Hook | | | 23 |
| *Louisiana.* | | | |
| Abbeville | | 15 | |
| Alexandria | | 16 | |
| Cameron | 14 | | |
| Cheneyville | | 15 | |
| Davis | | 15 | |
| Donaldsonville | | 16 | |
| Grand Coteau | 15 | | |
| Hammond | | 15 | |
| Houma | 15 | | |
| Jeanerette | | 15 | |
| Lafayette | | 15 | |
| Lake Charles | 7 | | |
| Maurepas | | 15 | |
| Melville | | 15 | |
| New Iberia | | 15 | |
| New Orleans | 16 | | |
| Rayne | 14 | | |
| Roseland | | 15 | |
| Schriever | | 22 | |
| Shreveport | | 15 | |
| Winnsboro | | 24 | |
| *Maine.* | | | |
| Bar Harbor | | | 15 |
| Belfast | | | 15 |
| Calais | | | 15 |
| Cornish | | | 15 |
| Easton | | | 15 |
| Eastport | | | 16 |
| Farmington | | | 15 |
| Fort Kent | | | 6 |
| Gardiner | | | 15 |
| Houlton | | | 15 |
| Lewiston | | | 15 |
| Portland | | | 15 |
| *Maryland.* | | | |
| Bachmans Valley | | | 15 |
| Baltimore | | | 15 |
| Barren Creek Springs | | | 24 |
| Chestertown | | | 15 |
| Cumberland | | | 21 |
| Darlington | | | 14 |
| Denton | | | 15 |
| Fallston | | | 15 |
| Fenby | | | 15 |
| Frederick | | | 19 |
| Mount Saint Marys | | | 14 |
| New Market | | | 14 |
| Solomons | | | 24 |
| Sunnyside | | | 15 |
| Valley Lee | | | 24 |
| Woodstock | | | 14 |
| *Massachusetts.* | | | |
| Amherst | | | 19 |
| Bedford | | | 16 |
| Beverly Farms | | | 20 |
| Blue Hill | | | 21 |
| Boston | | | 15 |
| Chestnut Hill | | | 15 |
| Concord | | | 5 |
| Dudley | | | 4 |
| East Templeton | | | 4 |
| Egg Rock, Nahant | | | 20 |
| Fiskdale | | | 4 |
| Fitchburg | | | 4 |
| Gilbertville | | | 19 |
| Hadley | | | 5 |
| Hingham | | | 20 |
| Lawrence | | | 20 |
| Leeds | | | 15 |
| Leicester | | | 4 |
| Leominster | | | 4 |
| Mansfield | | | 20 |
| Milton | | | 20 |
| Monson | | | 4 |
| *Massachusetts*—Cont'd. | | | |
| Mount Nonotuck | | | 4 |
| Nantucket | | | 20 |
| North Billerica | | | 19 |
| Plymouth | | | 20 |
| Provincetown | | | 20 |
| Randolph | | | 20 |
| Roxbury | | | 20 |
| Royalton | | | 4 |
| Salisbury | | | 16 |
| South Dennis | | | 19 |
| Taunton | | | 9 |
| Wakefield | | | 19 |
| Webster | | | 3 |
| Wellesley | | | 20 |
| Westboro | | | 19 |
| Winchester | | | 20 |
| Winthrop | | | 15 |
| Woods Holl | | 11 | |
| Worcester | | | 4 |
| *Michigan.* | | | |
| Adrian | | | 14 |
| Ann Arbor | | | 14 |
| Ball Mountain | | | 14 |
| Berrien Springs | | | 14 |
| Birmingham | | | 21 |
| Climax | | | 15 |
| Clinton | | | 20 |
| Escanaba | | | 15 |
| Fairview | | | 15 |
| Flint | | | 30 |
| Grand Rapids | | | 14 |
| Hanover | | | 21 |
| Hart | | | 14 |
| Hayes | | | 21 |
| Howell | | | 14 |
| Jeddo | | | 15 |
| Maysville | | | 14 |
| Ovid | | | 14 |
| Thornville | | | 21 |
| Vandalia | | | 15 |
| Washington | | | 15 |
| Williamston | | | 15 |
| *Minnesota.* | | | |
| Albert Lea | | | 11 |
| Belle Plaine | | | 2 |
| Bonniwells Mills | | | 21 |
| Cambridge | | | 21 |
| Carver | | | 21 |
| Clearwater | | | 21 |
| Dawson | | | 11 |
| Farmington | | | 2 |
| Grand Meadow | | | 11 |
| Hastings | | | 21 |
| Hutchinson | | | 2 |
| Mazeppa | | | 11 |
| Medford | | | 11 |
| Minneapolis | | | 2 |
| Minnesota City | | | 21 |
| Morris | | | 21 |
| New Richland | | | 11 |
| New Ulm | | | 21 |
| Redwood Falls | | | 29 |
| Rochester | | | 11 |
| Rolling Green | | | 11 |
| Royalton | | | 21 |
| Saint Charles | | | 11 |
| Saint Cloud | | | 21 |
| Saint Paul | | | 2 |
| Saint Peter | | | 21 |
| Sandy Lake Dam | | | 21 |
| Starbuck | | | 21 |
| Wabasha | | | 21 |
| Waconia | | | 15 |
| Warren | | | 2 |
| Winona | | | 21 |
| *Mississippi.* | | | |
| Biloxi | 15 | | |
| Briers | | 15 | |
| Edwards | | 15 | |
| Fayette | | 15 | |
| Hattiesburg | | 15 | |
| Louisville | 1 | 15 | |
| Moss Point | 15 | | |
| Pearlington | | 24 | |
| Vicksburg | | 15 | |
| Waynesboro | | 16 | |
| Woodville | | 15 | |
| *Missouri.* | | | |
| Bethany | | | 29 |
| Carrollton | | | 12 |
| Conception | | | 29 |
| Eight Mile | | | 29 |
| Fairport | | | 29 |
| Farmersville | | | 12 |
| Fox Creek | | | 26 |
| Gallatin | | | 12 |
| Gorin | | | 12 |
| Hannibal | | | 29 |
| Kansas City | | | 3 |
| Kidder | | | 12 |
| Lamonte | | | 29 |
| Liberty | | | 12 |
| McCune | | | 29 |
| *Missouri*—Continued. | | | |
| Marshall | | | 12 |
| New Boston | | | 12 |
| New Hartford | | | 29 |
| Oakfield | | 13 | |
| Oregon | | | 29 |
| Palmyra | | | 29 |
| Pickering | | | 29 |
| Princeton | | | 12 |
| Saint Joseph | | | 29 |
| Saint Louis | | | 17 |
| Sedalia | | | 29 |
| Shelbina | | | 27 |
| Springfield | | | 29 |
| Stellada | | | 17 |
| Unionville | | | 12 |
| Vilas | | | 29 |
| Warrensburg | | | 30 |
| Wheatland | | | 28 |
| *Nebraska.* | | | |
| Ansley | | | 11 |
| Arborville | | | 11 |
| Beatrice | | | 11 |
| Beaver City | | | 11 |
| Bratton | | | 11 |
| Callaway | | | 29 |
| Columbus | | | 11 |
| Cornlea | | | 11 |
| Creighton | | | 29 |
| Crete | | | 11 |
| Culbertson | | | 11 |
| David City | | | 11 |
| De Soto | | | 11 |
| Fairbury | | | 11 |
| Franklin | | | 11 |
| Geneva | | | 11 |
| Genoa | | | 11 |
| Glenwood | | | 11 |
| Golconda | | | 23 |
| Haigler | | | 11 |
| Harvard | | | 11 |
| Hebron | | | 11 |
| Holdrege | | | 11 |
| Imperial | | | 10 |
| Indianola | | | 2 |
| Kennedy | | | 10 |
| Lexington | | | 10 |
| Lincoln | | | 11 |
| Madrid | | | 11 |
| Marquette | | | 11 |
| Minden | | | 11 |
| Mullen | | | 11 |
| Nebraska City | | | 11 |
| Nesbit | | | 11 |
| North Platte | | | 10 |
| Ough | | | 10 |
| Red Cloud | | | 11 |
| Seward | | | 11 |
| Springview | | | 1 |
| Stanton | | | 11 |
| Superior | | | 11 |
| Syracuse | | | 30 |
| Table Rock | | | 11 |
| Tecumseh | | | 11 |
| Valentine | | | 11 |
| Wallace | | | 10 |
| Weeping Water | | | 11 |
| Whitman | | | 29 |
| *Nevada.* | | | |
| Candelaria | | | 23 |
| Carson City | | | 25 |
| Empire Ranch | | | 6 |
| Eureka Ranch | | | 13 |
| Genoa | | | 25 |
| Halleck | | | 23 |
| Hawthorne | | | 2 |
| Palisade | | | 23 |
| Palmetto | | | 17 |
| Reno | | | 24 |
| Toano | | | 6 |
| Tybo | | | 24 |
| Winnemucca | | | 22 |
| *New Hampshire.* | | | |
| Alstead | | | 15 |
| Antrim | | | 4 |
| Berlin Mills | | | 15 |
| Brookline | | | 4 |
| Concord | | | 15 |
| Dublin | | | 4 |
| East Canterbury | | | 19 |
| Grafton | | | 4 |
| Keene | | | 4 |
| Lancaster | | | 15 |
| Manchester | | | 4 |
| Nashua | | | 4 |
| Newton | | | 20 |
| North Conway | | | 22 |
| Plymouth | | | 20 |
| Sanbornton | | | 20 |
| West Milan | | | 15 |
| *New Jersey.* | | | |
| Bayonne | | | 20 |
| Beverly | | | 15 |
| Charlotteburg | | | 15 |

*Dates of first light and heavy frosts and snow*—Continued.

| State and station. | First frost. Light. | First frost. Heavy. | Snow. |
|---|---|---|---|
| *New Jersey*—Continued. | | | |
| Chester | | | 15 |
| Deckertown | | | 4 |
| Egg Harbor City | | | 19 |
| Elizabeth | | | 19 |
| Franklin Furnace | | | 16 |
| Franklinville | | | 15 |
| Freehold | | | 15 |
| Junction | | | 15 |
| Lambertville | | | 15 |
| Millville | | | 15 |
| Moorestown | | | 25 |
| Newark | | | 15 |
| New Brunswick | | | 20 |
| Paterson | | | 15 |
| Perth Amboy | | | 19 |
| Plainfield | | | 24 |
| Somerville | | | 19 |
| South Orange | | | 19 |
| Toms River | | | 19 |
| *New Mexico.* | | | |
| Albuquerque | | | 11 |
| Coolidge | | | 11 |
| Estalina Springs | | | 11 |
| Halls Peak | | | 11 |
| La Lus | | 12 | 11 |
| Santa Fe | | | 10 |
| Socorro | | | 20 |
| Taos | | | 25 |
| *New York.* | | | |
| Albany | | | 16 |
| Honeymead Brook | | | 15 |
| Lockport | | | 14 |
| Middletown | | | 15 |
| New Lisbon | | | 4 |
| North Hammond | | | 15 |
| Ogdensburg | | | 15 |
| Port Jervis | | | 15 |
| Rondout | | | 4 |
| South Kortright | | | 4 |
| Stillwater | | | 15 |
| Turin | | | 15 |
| Varysburg | | | 15 |
| Watkins | | | 23 |
| Waverly | | | 19 |
| Wedgwood | | | 4 |
| *North Carolina.* | | | |
| Bailey | | | 11 |
| Bakersville | | | 15 |
| Blowing Rock | | | 14 |
| Currituck Inlet | | 16 | |
| Falkland | | | 24 |
| Hatteras | 17 | 25 | |
| Henderson | | | 5 |
| Highlands | | | 21 |
| Kittyhawk | | 17 | 24 |
| Littleton | | | 23 |
| Mocksville | | | 17 |
| Mount Airy | | | 21 |
| Raleigh | | | 24 |
| Roxboro | | | 24 |
| Southport | | 16 | |
| Tarboro | | 1 | 23 |
| Willeyton | | | 24 |
| Wilmington | | 17 | |
| *North Dakota.* | | | |
| Fargo | | | 22 |
| *Ohio.* | | | |
| Akron | | | 15 |
| Annapolis | | | 15 |
| Ashland | | | 15 |
| Athens | | | 15 |
| Auburn | | | 23 |
| Bement | | | 15 |
| Benton Ridge | | | 21 |
| Big Prairie | | | 23 |
| Bladensburg | | | 23 |
| Bloomington | | | 23 |
| Bowling Green | | | 21 |
| Cambridge | | | 23 |
| Canal Dover | | | 15 |
| Canton | | | 23 |
| Cardington | | | 16 |
| Carrollton | | | 15 |
| Cincinnati | | | 15 |
| Clarksville | | | 23 |
| Cleveland | | | 15 |
| Columbus | | | 15 |
| Demos | | | 23 |
| Dupont | | | 10 |
| Ellsworth | | | 19 |
| Garrettsville | | | 15 |
| Greenville | | | 23 |
| Hanging Rock | | | 23 |
| Hillhouse | | | 16 |
| Hillsboro | | | 15 |
| Kenton | | | 24 |
| Kilbourne | | | 23 |
| Killbuck | | | 23 |
| Levering | | | 28 |
| Lordstown | | | 19 |
| Mansfield | | | 24 |
| Marietta | | | 23 |
| Marion | | | 27 |
| *Ohio*—Continued. | | | |
| Milligan | | | 23 |
| Napoleon | | | 19 |
| New Berlin | | | 24 |
| New Comerstown | | | 15 |
| New Holland | | | 23 |
| North Lewisburg | | | 24 |
| Northwood | | | 23 |
| Oberlin | | | 30 |
| Orangeville | | | 15 |
| Plattsburg | | | 15 |
| Portsmouth | | | 18 |
| Ridge | | | 15 |
| Ridgeville Corners | | | 21 |
| Rittman | | | 23 |
| Sandusky | | | 15 |
| Shenandoah | | | 23 |
| Stoutsville | | | 15 |
| Vermillion | | | 28 |
| Vickery | | | 30 |
| Warren | | | 15 |
| Wauseon | | | 15 |
| Waverly | | | 15 |
| Waynesboro | | | 15 |
| Westerville | | | 23 |
| Wheeler | | | 15 |
| Zanesville | | | 24 |
| *Oklahoma.* | | | |
| Oklahoma | | 13 | |
| *Oregon.* | | | |
| Astoria | | 1 | |
| Portland | | | 2 |
| Roseburg | | 17 | |
| The Dalles | | | 23 |
| Umatilla | | | 23 |
| *Pennsylvania.* | | | |
| Altoona | | | 15 |
| Clarion | | | 19 |
| Dubois | | | 19 |
| East Mauch Chunk | | | 19 |
| Easton | | | 14 |
| Freeport | | | 30 |
| Harrisburg | | | 15 |
| Johnstown | | | 15 |
| Kilmer | | | 15 |
| Lock Haven | | | 19 |
| Parkers Landing | | | 19 |
| Philadelphia | | | 20 |
| Quakertown | | | 15 |
| Selins Grove | | | 21 |
| State College | | | 15 |
| Warren | | | 16 |
| West Chester | | | 15 |
| West Newton | | | 16 |
| *Rhode Island.* | | | |
| Block Island | | 1 | |
| *South Carolina.* | | | |
| Aiken | | 16 | |
| Allendale | | 24 | |
| Blacksburg | | | 21 |
| Charleston | | 25 | |
| Georgetown | | 25 | |
| McCormick | 23 | 25 | |
| Port Royal | 16 | 25 | |
| Society Hill | | 15 | |
| Trial | | 1 | |
| *South Dakota.* | | | |
| Aberdeen | | | 21 |
| Alexandria | | | 2 |
| Brookings | | | 11 |
| Flandreau | | | 2 |
| Howard | | | 2 |
| Piedmont | | | 1 |
| Rosebud | | | 1 |
| Wentworth | | | 24 |
| Wolsey | | | 2 |
| *Tennessee.* | | | |
| Pikeville | | | 14 |
| Riddleton | | | 19 |
| *Texas.* | | | |
| Abilene | | | 14 |
| Amarillo | | | 11 |
| Aurora | | 18 | |
| Brazoria | 15 | | |
| Brownwood | | 15 | |
| Childress | | 4 | |
| Coldwater | | | 11 |
| College Station | 15 | | |
| Columbia | 15 | | |
| Corsicana | | 15 | |
| Duval | | 24 | |
| El Paso | | 12 | |
| Gainesville | | | 14 |
| Hallettsville | 15 | | |
| Houston | | 15 | |
| Llano | 15 | | |
| Longview | | 15 | |
| McGregor | | 18 | |
| Marshall | | 15 | |
| New Braunfels | 15 | | |
| Palestine | | 15 | |
| San Antonio | 15 | 24 | |
| Stella | 10 | 15 | |
| Victoria | 15 | | |

*Dates of first light and heavy frosts and snow*—Continued.

| State and station. | First frost. Light. | First frost. Heavy. | Snow. |
|---|---|---|---|
| *Texas*—Continued. | | | |
| Waco | | 15 | |
| *Utah.* | | | |
| Cisco | | | 17 |
| Green River | | | 25 |
| Grouse Creek | | | 16 |
| Levan | | | 16 |
| Loa | | | 17 |
| Logan | | | 1 |
| Losee | | | 17 |
| Moab | | | 17 |
| Ogden | | | 21 |
| Parowan | | | 9 |
| Provo City | | | 16 |
| Scofield | | | 25 |
| Snowville | | | 23 |
| *Vermont.* | | | |
| Cornwall | | | 8 |
| Simonsville | | | 21 |
| Vernon | | | 21 |
| Wells | | | 15 |
| *Virginia.* | | | |
| Alexandria | | | 21 |
| Ashland | | | 15 |
| Avon | | | 21 |
| Bedford City | | | 21 |
| Birdsnest | | | 24 |
| Cape Charles | | | 24 |
| Cape Henry | | | 24 |
| Charlottesville | | | 21 |
| Clarksville | | | 23 |
| Dale Enterprise | | | 14 |
| Falls Church | | | 15 |
| Hampton | | 16 | 24 |
| Hot Springs | | | 15 |
| Irwin | | | 21 |
| Lexington | | | 21 |
| Lynchburg | | | 21 |
| Marion | | | 15 |
| Norfolk | 1 | | 24 |
| Nottoway | | | 24 |
| Petersburg | | 20 | 23 |
| Richmond | | | 24 |
| Riverton | | | 21 |
| Saluda | | | 24 |
| Spottsville | | | 24 |
| Stanardsville | | | 21 |
| Staunton | | | 21 |
| Stephens City | | | 19 |
| *Washington.* | | | |
| Aberdeen | | | 23 |
| Anacortes | | | 23 |
| Bridgeport | | | 12 |
| Colfax | | | 2 |
| Dayton | | | 22 |
| East Clallam | | | 22 |
| Elbe | | | 2 |
| Ellensburg | | | 23 |
| Ferry | | | 23 |
| Fort Canby | | 1 | |
| Fort Simcoe | | | 23 |
| Fort Townsend | | | 21 |
| Lakeside | | | 19 |
| Moxee | | | 2 |
| *Washington*—Cont'd. | | | |
| Neah Bay | | | 23 |
| Olympia | | | 23 |
| Pine Hill | | | 23 |
| Pomeroy | | | 17 |
| Pullman | | | 2 |
| Tacoma | | | 23 |
| Tatoosh Island | | 1 | 23 |
| Union City | | | 23 |
| Walla Walla | | | 23 |
| Waterville | | | 2 |
| West Ferndale | | | 2 |
| *West Virginia.* | | | |
| Bluefield | | | 15 |
| Buckhannon | | | 14 |
| Central | | | 14 |
| Charleston | | | 15 |
| Elkhorn | | | 14 |
| Ella | | | 15 |
| Glenville | | | 14 |
| Grafton | | | 15 |
| Harpers Ferry | | | 9 |
| Marlinton | | | 21 |
| Martinsburg | | | 21 |
| Nuttallburg | | | 14 |
| Point Pleasant | | | 24 |
| Spencer | | | 23 |
| *Wisconsin.* | | | |
| Amherst | | | 21 |
| Baraboo | | | 21 |
| Barron | | | 1 |
| Bayfield | | | 14 |
| Beaver Dam | | | 21 |
| Beloit | | | 21 |
| Black River Falls | | | 12 |
| Cadiz | | | 21 |
| Centralia | | | 21 |
| Chippewa Falls | | | 15 |
| Delavan | | | 21 |
| Eau Claire | | | 21 |
| Fond du Lac | | | 13 |
| Harvey | | | 21 |
| Janesville | | | 21 |
| Lancaster | | | 13 |
| Lincoln | | | 14 |
| Madison | | | 21 |
| Manitowoc | | | 21 |
| Menomonie | | | 2 |
| Milwaukee | | | 12 |
| Neillsville | | | 14 |
| New Holstein | | | 13 |
| Oconomowoc | | | 15 |
| Oconto | | | 22 |
| Pepin | | | 11 |
| Portage | | | 21 |
| Prairie du Chien | | | 12 |
| Raymond | | | 14 |
| Reedsburg | | | 12 |
| Sharon | | | 15 |
| Shawano | | | 15 |
| Valley Junction | | | 14 |
| Waukesha | | | 15 |
| Watertown | | | 21 |
| Westfield | | | 15 |

## PERIODS OF HIGH TEMPERATURE.

The most interesting period of high temperature was that which prevailed on the 1st from Colorado and New Mexico northeastward to Michigan, when the maximum temperatures of the month occurred over this region. On the 2d this area had moved eastward and became a much longer and narrower oval from southern Texas to Vermont. On the 3d this warm wave prevailed over the east Gulf states and the entire Atlantic coast. There is every evidence that these warm waves are the combined result of insolation in a clear sky, and of the dynamic warming due to a rather rapid descent; when air is slowly descending in a clear sky the dynamic heating may be counteracted by cooling due to gaseous radiation, and the descending air becomes a cold wave, but when rapidly descending, the descending air becomes a warm wave and the cooling by radiation must complete its process after the air reaches the ground.

## PERIODS OF COLD WEATHER.

The minimum temperatures for the month generally occurred on the 30th in the Northwest, but a movement of low temperature began on the Pacific coast on the 19th, extended

eastward to the eastern slope on the 23d, prevailed over the Mississippi and Ohio valleys and the Gulf States on the 24th, and on the south Atlantic coast on the 25th, the middle Atlantic states on the 26th, and New England on the 27th. During this eastward progress the minimum temperatures occurred as follows: In the Pacific states 23 to 32 on the 17th, 18th, and 19th; on the eastern slope 8 at lower stations and 2 at the summit of Pikes Peak; on the 24th, —10 at northern stations, +10 in the central and +40 at the southern limit; on the 25th, from 20 to 30 in the south Atlantic states; on the 26th, from 15 to 25 in the middle Atlantic states and lower lake region; on the 27th, from 2 to 27 in New England.

## PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for November, 1893, as determined by reports from about 2,000 stations, is exhibited on Chart III. In the meteorological tables the total precipitation is given for each station; the departures from the normal are given for regular stations of the Weather Bureau in the table of climatological data. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

### NORMAL PRECIPITATION.

The normal precipitation for November is greatest on the coast of Washington and Oregon, and least in the extreme northwest, as shown by the following selected stations: Tatoosh, Wash., 11.9; Fort Canby, Wash., 8.2; Olympia, Wash., 6.5; Roseburg, Oregon, 3.6; Portland, Oregon, 6.0; Assiniboine, Mont., 0.6; Bismarck, N. Dak., 0.7; Fort Buford, N. Dak., 0.5; Cheyenne, Wyo., 0.3; Fort Custer, Mont., 0.4; Dodge City, Kans., 0.5; Las Animas, Colo., 0.2; North Platte, Nebr., 0.4; Saint Vincent, Minn., 0.6; Fort Sully, S. Dak., 0.4; Valentine, Nebr., 0.5; Yuma, Ariz., 0.3.

### PRECIPITATION FOR NOVEMBER, 1893.

In November, 1893, the monthly precipitation was over 6 in southeastern Virginia and at Cape Hatteras, N. C., also in Louisiana, except near the mouth of the Mississippi. More than 6 fell at most stations in northern California and near the coast of Oregon and Washington. The maximum rainfalls were from 12 to 18 on the coast of Washington and Oregon; the exceptionally heavy rainfalls were 20 at a voluntary station near Roseburg and 34 near Portland. In the interior the precipitation has been mostly in the form of snow which, when melted, gave a maximum of 5.09 at Sault Ste. Marie, Mich., and 5.56 at Parry Sound, Ont. The stations that have reported no measurable precipitation during November have been confined generally to Arizona, New Mexico, eastern Colorado, western Kansas, and Nebraska.

### DEPARTURES FROM NORMAL PRECIPITATION.

The precipitation was in excess of the normal at a few stations in the east Atlantic states and at most stations on the North Carolina and Virginia coasts, where the excess averaged about 3; a slight excess was also reported at Detroit and Port Huron, Mich., Davenport and Keokuk, Iowa. The principal area of excess includes Montana, Washington, Oregon, and northern California; the maximum excess was 7.3 at Eureka, Cal., 6.4 at Fort Canby, Wash., and 6.6 at Olympia, Wash.

Considered by districts, the monthly precipitation for November, 1893, when compared with the normal for the month, furnishes the following percentages; the precipitation is in excess when the percentages of the normal exceed 100: Middle Pacific coast, 204; northern plateau, 182; north Pacific coast, 159; northern slope, 121; middle Atlantic states, 112; west Gulf states, 98; middle plateau, 90; upper Lake region, 88; extreme northwest, 86; south Atlantic and east Gulf states, 81; lower lake region and upper Mississippi valley, 78; middle slope, 73; Ohio Valley and Tennessee, 66; Missouri Valley, 61; New England, 53; southern plateau, 41; south Pacific coast, 38; southern slope, 37; Key West, 19.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for November for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for November, 1893; (4) the departure of the current month from the average; (5) the extremes for November during the period of observation and the years of occurrence:

| State and station. | (1) Average for the month of Nov. | (2) Length of record. | (3) Total for Nov., 1893. | (4) Departure from average. | (5) Extremes for November. | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Greatest. | | Least. | |
| | | | | | Am't. | Year. | Am't. | Year. |
| *Arizona.* | *Inches.* | *Years* | *Inches.* | *Inches.* | *Inches.* | | *Inches* | |
| Fort Apache | 1.18 | 17 | 0.28 | — 0.90 | 2.83 | 1890 | 0.00 | 1891 |
| Fort Mohave | 0.61 | 21 | 0.28 | — 0.33 | 6.16 | 1888 | 0.00 | * |
| Whipple Barracks | 0.78 | 21 | 1.16 | + 0.38 | 3.18 | 1888 | 0.00 | * |
| *Arkansas.* | | | | | | | | |
| Keesees Ferry | 4.34 | 12 | 2.51 | — 1.83 | 8.85 | 1891 | 2.10 | 1892 |
| *California.* | | | | | | | | |
| Riverside | 0.68 | 13 | 0.48 | — 0.20 | 2.47 | 1888 | 0.00 | 1883, '91 |
| *Colorado.* | | | | | | | | |
| Las Animas | 0.22 | 12 | T. | — 0.22 | 0.70 | 1885 | 0.00 | 1890, '91 |
| *Florida.* | | | | | | | | |
| Merritts Island | 2.26 | 15 | 1.99 | — 0.27 | 5.67 | 1884 | 0.17 | 1886 |
| *Georgia.* | | | | | | | | |
| Forsyth | 3.44 | 19 | 1.54 | — 1.90 | 5.41 | 1888 | 0.50 | 1890 |
| *Idaho.* | | | | | | | | |
| Boise Barracks | 1.09 | 20 | 3.14 | + 2.05 | 4.43 | 1874 | 0.00 | 1890 |
| Fort Sherman | 2.77 | 10 | 7.00 | + 4.23 | 7.00 | 1892–'93 | 0.29 | 1882 |
| *Indiana.* | | | | | | | | |
| Lafayette | 3.24 | 11 | 2.65 | — 0.59 | 6.31 | 1891 | 1.44 | 1884 |
| *Iowa.* | | | | | | | | |
| Cresco | 1.46 | 22 | 0.84 | — 0.62 | 5.20 | 1879 | 0.18 | 1875 |
| *Kansas.* | | | | | | | | |
| Independence | 1.89 | 21 | 1.44 | — 0.45 | 3.90 | 1876 | 0.06 | 1872 |
| *Louisiana.* | | | | | | | | |
| Grand Coteau | 3.39 | 10 | 6.42 | + 3.03 | 6.42 | 1893 | 1.51 | 1890 |
| *Maine.* | | | | | | | | |
| Orono | 4.57 | 23 | 1.43 | — 3.14 | 8.76 | 1886 | 1.43 | 1893 |
| *Maryland.* | | | | | | | | |
| Cumberland | 2.34 | 22 | 2.01 | — 0.33 | 5.34 | 1889 | 0.82 | 1887 |
| *Michigan.* | | | | | | | | |
| Kalamazoo | 2.61 | 17 | 2.09 | — 0.52 | 5.77 | 1877 | 1.25 | 1882 |
| *Missouri.* | | | | | | | | |
| Sedalia | 2.02 | 15 | 2.16 | + 0.14 | 3.17 | 1881 | 0.53 | 1885 |
| *Montana.* | | | | | | | | |
| Fort Custer | 0.52 | 14 | 1.68 | + 1.16 | 1.68 | 1891–'93 | 0.05 | 1887 |
| *Nebraska.* | | | | | | | | |
| Fort Robinson | 0.52 | 10 | 0.23 | — 0.29 | 1.70 | 1885 | 0.07 | 1892 |
| Genoa (near) | 0.70 | 17 | 0.72 | + 0.02 | 1.43 | 1886 | T. | 1883 |
| *Nevada.* | | | | | | | | |
| Browns | 0.20 | 21 | ..... | ..... | 1.39 | 1885 | 0.00 | * |
| Carson City | 1.63 | 16 | 1.49 | — 0.14 | 7.01 | 1875 | 0.00 | 1884 |
| *New Hampshire.* | | | | | | | | |
| Hanover | 3.66 | 22 | 0.94 | — 2.72 | 6.62 | 1885 | 0.59 | 1882 |
| *New Mexico.* | | | | | | | | |
| Deming | 0.81 | 11 | 0.06 | — 0.75 | 1.80 | 1892 | 0.00 | 1886, '91 |
| Fort Wingate | 0.67 | 20 | ..... | ..... | 2.12 | 1878 | 0.00 | * |
| *New York.* | | | | | | | | |
| Cooperstown | 3.08 | 22 | 2.20 | — 0.88 | 4.72 | 1886 | 1.45 | 1876 |
| Plattsburg Barracks | 2.38 | 22 | 1.28 | — 1.10 | 4.39 | 1885 | 0.54 | 1882 |
| *North Carolina.* | | | | | | | | |
| Lenoir | 3.39 | 21 | 2.20 | — 1.19 | 7.60 | 1877 | 0.00 | 1890 |
| *Oklahoma.* | | | | | | | | |
| Fort Reno | 0.97 | 10 | 0.93 | — 0.04 | 3.38 | 1884 | 0.00 | 1886, '92 |
| Fort Sill | 1.44 | 21 | 1.30 | — 0.14 | 4.06 | 1890 | 0.19 | 1872 |
| Fort Supply | 1.01 | 13 | 0.70 | — 0.31 | 3.30 | 1874 | 0.10 | 1886 |
| *Oregon.* | | | | | | | | |
| Bandon | 6.16 | 15 | 14.04 | + 7.88 | 18.21 | 1885 | 0.33 | 1890 |
| *Pennsylvania.* | | | | | | | | |
| Dyberry | 3.21 | 22 | 2.17 | — 1.04 | 7.00 | 1886 | 1.40 | 1882 |
| Grampian | 3.03 | 17 | 1.72 | — 1.31 | 6.03 | 1886 | 1.42 | 1872 |
| Wellsboro | 4.28 | 14 | 3.00 | — 1.28 | 9.07 | 1889 | 0.93 | 1890 |
| *South Carolina.* | | | | | | | | |
| Statesburg | 1.85 | 12 | 2.19 | + 0.34 | 3.90 | 1882 | 0.87 | 1886 |
| *South Dakota.* | | | | | | | | |
| Fort Sully | 0.42 | 22 | 0.55 | + 0.13 | 1.60 | 1886 | 0.00 | 1883 |